State of health economic evaluation research in Saudi Arabia: a review

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Background: If evaluation of economic evidence is to be used increasingly in Saudi Arabia, a review of the published literature would be useful to inform policy decision-makers of the current state of research and plan future research agendas. The purpose of this paper is to provide a critical review of the state of health economic evaluation research within the Saudi context with regard to the number, characteristics, and quality of published articles.

Methods: A literature search was conducted on May 8, 2011 to identify health economic articles pertaining to Saudi Arabia in the PubMed, Embase, and EconLit databases, using the following terms alone or in combination: “cost*”, “economics”, “health economics”, “cost-effectiveness”, “cost-benefit”, “cost minimization”, “cost utility analysis”, and “Saudi”. Reference lists of the articles identified were also searched for further articles. The tables of contents of the Saudi Pharmaceutical Journal and the Saudi Medical Journal were reviewed for the previous 5 years.

Results: The search identified 535 citations. Based on a reading of abstracts and titles, 477 papers were excluded. Upon reviewing the full text of the remaining 58 papers, 43 were excluded. Fifteen papers were included. Ten were categorized as full economic evaluations and five as partial economic evaluations. These articles were published between 1997 and 2010. The majority of the studies identified did not clearly state the perspective of their evaluation. There are many concerns about the methods used to collect outcome and costs data. Only one study used some sort of sensitivity analysis to assess the effects of uncertainty on the robustness of its conclusions.

Conclusion: This review highlights major flaws in the design, analysis, and reporting of the identified economic analyses. Such deficiencies mean that the local economic evidence available to decision-makers is not very useful. Thus, building research capability in health economics is warranted.

Keywords: cost-effective analysis, pharmacoeconomics, economic evaluation, quality assessment, Saudi Arabia

Introduction
In Saudi Arabia, health care services are provided primarily by the Ministry of Health through a network of 2037 health care centers and a broad base of 244 general and specialist hospitals. Other governmental agencies, such as the Ministry of Defense and Aviation, the Ministry of the Interior, the Saudi Arabian National Guard, and the Saudi Arabian Oil Company, finance and deliver primary, secondary, and tertiary care to a defined population, usually employees and their dependants. The Saudi government also finances and provides care on a referral basis in specialized tertiary care hospitals, such as King Faisal Specialist Hospital and Research Center. Services offered
by public hospitals are free of charge for all eligible citizens. The private sector also contributes to the delivery of health care services, especially in cities and large towns, with a total of 125 hospitals (11,833 beds), 2218 dispensaries, and clinics. In addition, Saudi working for the private sector and expatriates are eligible for a comprehensive package of health insurance benefits. The Council of Cooperative Health Insurance, an independent government body, regulates and supervises a health insurance strategy for the Saudi health care market. The Ministry of Health is responsible for managing, planning, and formulating health policies, and supervising health programs, as well as monitoring health services in the private sector. The Ministry of Health was historically the regulatory authority responsible for licensing pharmaceutical products, medical devices, and manufacturing facilities, but the Saudi Food and Drug Authority took over this function in July 2009.

In 2012, the government has allocated SAR 86 billion towards health and social affairs, a 26% increase on the previous year’s budget. Despite that, the steady increase in health care costs because of technological advances, the growing number of people with chronic diseases, and high demand resulting from free services, means that Saudi decision-makers will struggle to make choices concerning allocation of health care resources.

Economic evaluation is a technique that has been developed by economists to assist decision-making when choices have to be made between several courses of action. By definition, economic evaluation is a comparative analysis of alternative courses of action in terms of their costs and consequences. It addresses the question of whether something is worth doing when compared with other possible uses of the same resources to ensure that efficiency has been attained or approached. Inefficiency exists when resources could be reallocated in a way that would increase the health outcomes produced.

Many countries have started to use economic evidence to support decisions on licensing, pricing, reimbursement, or addition to the formulary. In Saudi Arabia, it is not mandatory to submit evidence of economic evaluation to support licensing decisions; however, data will be considered if submitted. The new Saudi Food and Drug Authority guidelines for pricing of pharmaceuticals indicate that pharmacoeconomic evidence will be utilized to supplement pricing decisions. In a survey of 48 Saudi Pharmacy and Therapeutics Committee members, two thirds of the respondents stated that they used pharmacoeconomic evaluation in their formulary decision-making processes and 80% of respondents stated that pharmacoeconomics should be used as a decision-making tool, as in the rest of the world.

If evaluation of economic evidence is to be used increasingly in Saudi Arabia, a review of the published literature would be useful to inform policy decision-makers on the current state of research and to plan future research agendas. The purpose of this paper is to provide a critical review of the state of health economic evaluation within the Saudi context with regard to the number, characteristics, and quality of published articles.

Materials and methods
Literature search strategy
A literature search was undertaken on May 8, 2011 to identify papers on health economics pertaining to Saudi Arabia in the PubMed, Embase, EconLit databases, using the following terms alone and in combination: “cost*”, “economics”, “health economics”, “cost-effectiveness”, “cost-benefit”, “cost minimization”, “cost utility analysis”, and “Saudi”. The databases were searched without language restriction or publication year limits (ie, from the start of the databases). The tables of contents for the Saudi Pharmaceutical Journal and the Saudi Medical Journal from May 2007 to May 2011 were reviewed by the author. The search was restricted to the last 5 years because the task is time-consuming. Google scholar was also searched. Reference lists of the articles were also searched for additional articles.

Literature selection criteria
Articles were excluded if there was no statement or word in the title, abstract, or keywords that indicated that an economic (including cost) analysis was conducted. Articles were also excluded if they were not original economic evaluations (eg, if the paper was a narrative review on cost-effectiveness), not pertaining to Saudi Arabia, not published in a fully peer-reviewed journal (eg, conference proceeding abstracts), or did not address a health-related topic. Titles and abstracts were screened by a group of three PharmD students following a 15-week course of pharmacoeconomics at the College of Pharmacy, King Saud University. The author explained the inclusion and exclusion criteria to the students. Two students independently screened the titles and abstracts of identified citations for potential eligibility using a standardized screening guide. A random selection of titles and abstracts was independently reviewed by the author to ensure the accuracy of the inclusion and exclusion process. The citations judged potentially eligible by at least one student were retrieved
in full text. The author then read the full texts of potential papers to confirm that they satisfied the inclusion criteria.

Synthesis and reporting

Depending on whether both costs and consequences had been considered and whether a comparison with alternative treatment was made, the studies included were classified by the author into two categories, ie, partial economic evaluations (cost outcome description, cost comparison) and full economic evaluations (cost-effective analysis, cost-benefit analysis, cost-utility analysis, cost-minimization analysis). Data were recorded about the author, year of the study, sample, methods, sample size, study focus, and main findings. The methodological quality was assessed against published criteria.4

Results

In total, the comprehensive search identified 535 citations. Based on a reading of abstracts and titles, 477 papers were excluded. The remaining 58 articles were retrieved in full text and reviewed by the author. Upon reviewing the 58 articles, 43 were excluded (Figure 1). No additional references were identified during searching of bibliographies. Searching the tables of contents for the Saudi Pharmaceutical Journal and the Saudi Medical Journal and a Google Scholar search did not identify any additional citations. Ten studies8–17 described cost and outcomes for two interventions or more and were categorized as full economic evaluations. Five studies18–22 were considered to be partial economic evaluations. The earliest study was published in 19978 and the latest was published in 2010.9 Four studies were published in Saudi journals and 11 were published in non-Saudi journals. Only one study was published in a specialized economic journal.10

Characteristics of full economic evaluations

A description of the main characteristics for each of the papers included according to year of publication is provided in Table 1. In two papers,8,15 the aim did not contain any reference to measurement of cost, cost-effectiveness, or cost-benefit. In the remaining papers, the aim was to assess cost-effectiveness (n = 4),9,13,14,16 cost-benefit (n = 1),12 or compare costs with outcomes (n = 3).10,11,17 Eight studies compared two alternatives and one compared three alternatives. Four compared intervention using a “do nothing” strategy. The articles included had addressed a wide number of intervention areas. Seven studies were on pharmaceuticals, two were on surgery, one was on a mixture of interventions for intensive care patients, and one was on diagnostic procedures.

As Table 1 shows, six of the included studies collected effectiveness measures using a prospective design,9–13,17 three using pre-intervention and post-intervention design,8,15,16 and one using a retrospective design.14 Only one study calculated a sample size.12 The study periods were one year or less (n = 5),8,9,11,12,17 two years (n = 2),15,16 six years (n = 1),13 and eight years (n = 1).14 One study projected outcomes and costs over 40 years using a Markov modeling technique.10 The time horizon of the study or the follow-up period was not clear in some studies, but appeared to be duration of hospital stay. Most of the studies measured outcomes using natural units. The main outcome measures reported were intermediate disease-specific outcomes (n = 6), survival rate (n = 3), and quality-adjusted life years (n = 1).

The costs of pharmaceuticals (n = 5), length of stay (n = 4), and instruments and consumables (n = 2), along with personal (n = 3) and productivity costs (n = 1) were considered. The currency used for cost valuation included US dollars (n = 6)8,9,11,12,16,17 and local currency (n = 4).10,13–15 In seven papers, one intervention was dominant,8,10,14,16 ie, cost less and achieved better outcomes, in two studies one intervention was cheaper with equivalent outcomes,15,17 and one study found one intervention to be more expensive but with a better outcome.9

Characteristics of partial economic evaluations

Two studies were medication utilization reviews and reported the associated total costs of the medications concerned8,19 (Table 2). One study presented costs and consequences for

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**Figure 1** Flow diagram of literature selection for systematic review.
Table 1 Characteristics of full economic evaluations (n = 10)

<table>
<thead>
<tr>
<th>Reference</th>
<th>Population (n)</th>
<th>Interventions</th>
<th>Effectiveness measure</th>
<th>Source of effectiveness</th>
<th>Cost categories</th>
</tr>
</thead>
<tbody>
<tr>
<td>Al-Tawfiq and Abed8</td>
<td>ICU patients</td>
<td>IHI care measure for patients on ventilation versus no IHI measures</td>
<td>VAP rate</td>
<td>Pre and post trial</td>
<td>Length of hospital stay</td>
</tr>
<tr>
<td>Sabry et al7</td>
<td>ESRD hemodialysis patients (23)</td>
<td>UFH versus tinzaparin during dialysis</td>
<td>Clotting rate</td>
<td>Prospective crossover trial</td>
<td>Medications</td>
</tr>
<tr>
<td>Ali et al9</td>
<td>Type 2 diabetes patients, hypothetical cohort</td>
<td>Biphasic insulin aspart 30 versus human insulin</td>
<td>QALY</td>
<td>Prospective controlled trial</td>
<td>Medications, screening, complications management</td>
</tr>
<tr>
<td>Mammo et al11</td>
<td>Thrombophilia (2111) blood samples</td>
<td>Light cycler versus PCR diagnostic test</td>
<td>Test conformity and reproducibility</td>
<td>Prospective trial</td>
<td>Reagents, consumables, equipment, personal, patient</td>
</tr>
<tr>
<td>Abbas et al12</td>
<td>Workers from industry (2400)</td>
<td>Influenza vaccination versus no vaccination</td>
<td>Influenza-like illnesses</td>
<td>Prospective trial</td>
<td>Vaccine, personal, productivity loss</td>
</tr>
<tr>
<td>Pejaver et al13</td>
<td>Neonatal with RDS (145)</td>
<td>Surfactant replacement therapy versus no surfactant</td>
<td>Survival rate</td>
<td>Prospective trial</td>
<td>Surfactant, personal, equipment, length of hospital stay</td>
</tr>
<tr>
<td>Qari et al4</td>
<td>Thyrotoxicosis (100)</td>
<td>Medical versus surgery versus radioactive iodine</td>
<td>Remission rate</td>
<td>Retrospective</td>
<td>Not clear</td>
</tr>
<tr>
<td>Jawad et al15</td>
<td>Cholelithiasis in children (11)</td>
<td>Laparoscopic cholecystectomy versus open cholecystectomy</td>
<td>Mortality and major post-operative complications</td>
<td>Pre- and post-trial</td>
<td>Surgery, length of hospital stay</td>
</tr>
<tr>
<td>Al Umran and Yaseen16</td>
<td>Neonates with HMD (83)</td>
<td>Surfactant replacement therapy versus no surfactant</td>
<td>Survival rate</td>
<td>Pre- and post-trial</td>
<td>Length of hospital stay</td>
</tr>
<tr>
<td>Kubeyinje17</td>
<td>Herpes zoster</td>
<td>Oral acyclovir</td>
<td>Zoster-associated pain and medication complications</td>
<td>Prospective trial</td>
<td>Medications</td>
</tr>
</tbody>
</table>

Abbreviations: IHI, Institute for Healthcare Improvement bundle; ICU, intensive care unit; VAP, ventilator-associated pneumonia; ESRD, end-stage renal failure; UFH, unfractionated heparin; QALY, quality-adjusted life years; PCR, polymerase chain reaction; RDS, respiratory distress syndrome; HMD, hyaline membrane disease.

Quality of full economic evaluations

Table 3 shows the extent to which the studies included the following key elements of economic evaluation.

- **Effectiveness**: The perspective taken was specified explicitly in only one of the reviewed papers, although it appears to have been that of the hospital for most of the included studies. However, there were some studies that did not specify the perspective taken, which also included cost components, like the costs borne by patients themselves, and lost productivity costs.

- **Costs and outcomes**: The perspective taken was specified explicitly only in one paper, as shown in Table 2. The studies collected data over a period of one year or less, and one study collected data for more than one year.

- **Cost categories**: Four studies collected data over a period of one year and presented the cost savings achieved by vaccination of individuals at risk.

- **Discounted costs**: In one study, discounted costs were used in one study, but it appears to have been that of the hospital for most of the included studies. However, there were some studies that did not specify the period of discount.

- **Sensitivity analysis**: In all the papers identified, data on effectiveness came from a single clinical study. In many papers, the calculation of cost components was reported as a percentage of the cost data. Discounted costs were used in one study, and in one study that included cost components, like the costs borne by patients themselves, and lost productivity costs.

- **Sensitivity analysis**: The perspective taken was specified explicitly only in one paper, as shown in Table 2. The studies collected data over a period of one year or less, and one study collected data for more than one year.

As shown in Table 2, the studies collected data over a period of one year or less, and one study collected data for more than one year.
Table 2 Characteristics of partial economic evaluations (n = 5)

<table>
<thead>
<tr>
<th>Author</th>
<th>Population, sample size</th>
<th>Interventions</th>
<th>Design</th>
<th>Costs categories</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alsultan et al(^{18})</td>
<td>Patients using PPI (225)</td>
<td>Intravenous PPI</td>
<td>Retrospective</td>
<td>Intravenous PPI</td>
</tr>
<tr>
<td>Alangawi et al(^{17})</td>
<td>Patients using IVIG (305)</td>
<td>IVIG</td>
<td>Retrospective</td>
<td>IVIG</td>
</tr>
<tr>
<td>Jawadi and Abdul-Samad(^{19})</td>
<td>Femoral fracture in children (178)</td>
<td>Intramedullary K wire</td>
<td>Retrospective</td>
<td>K wire</td>
</tr>
<tr>
<td>Almuneef et al(^{22})</td>
<td>Health care workers (2047)</td>
<td>Varicella zoster virus</td>
<td>Survey</td>
<td>Antibody screening tests</td>
</tr>
<tr>
<td>Mitwali et al(^{21})</td>
<td>Hemodialysis patients (10)</td>
<td>Reuse of hemodialyzer</td>
<td>Prospective</td>
<td>Dialyzer, consumables</td>
</tr>
</tbody>
</table>

Abbreviations: PPI, proton pump inhibitors; IVIG, intravenous immunoglobulin; K wire, Kirschner wire.

Discussion

Characteristics of economic evaluation in Saudi Arabia

Compared with the number of economic evaluations found for other developing countries, such as Bangladesh\(^{33}\) (n = 12), Nigeria\(^{34}\) (n = 44), Zimbabwe\(^{35}\) (n = 26), Thailand\(^{26}\) (n = 41), and Korea\(^{27}\) (n = 45), Saudi seems to be lagging behind in conducting health-related economic evaluations. An important observation is that the economic evaluations identified by this research are extremely heterogeneous and assess an intervention after its diffusion into practice. This suggests that health economics assessment is used on an ad hoc basis rather than as a systematic approach to compare alternatives and make decisions that maximize efficiency.

Quality of economic evaluation

There were many flaws in the design, analysis, and reporting of the economic evaluations identified. The perspective of an economic evaluation is an important issue dictating which outcomes and costs should be measured, but the perspective taken was reported by only one study.\(^{19}\) Consequently, the author could not assess if all important and relevant outcomes and costs for each alternative were identified.

A serious and common methodological pitfall was found, ie, poor quality of effectiveness data. None of the studies based evidence of effectiveness on the “gold standard” of randomized, clinical trials. Instead, the effectiveness data came mainly from small, single, retrospective, or non-randomized prospective studies. This may introduce bias which weakens the conclusions of any economic evaluation. Also, many papers used intermediate disease-specific measures of benefit. Intermediate outputs are appropriate only to the extent that a valid link can be established between these and a final health output.\(^{3}\) Furthermore, these measures do not allow for meaningful comparison of cost-effectiveness across disease areas. Only one study used quality-adjusted life years as an outcome measure. The use of quality-adjusted life years is recommended not only because it enables cross-disease comparisons to be made, but also because it captures the impact of disease on a patient’s quality of life.

Another shortcoming of the existing studies is failure to describe clearly the methods used to collect and evaluate data on use of resources. The reason for inclusion or exclusion of specific resources was not explained. Moreover, details on type and quantities of resources used were not provided, which undermines the external relevance of the results of these evaluations. Unit prices were not presented separately from quantities of resources, which limits the possibility of replicating the analysis in other settings. The date to which the prices referred was not reported, and again this limits the reproducibility of the results.

Another serious methodological pitfall was inadequate handling of uncertainty around benefits and cost estimates by sensitivity analysis. In sensitivity analysis, uncertain key parameters are varied to assess the impact of uncertainty on the robustness of any conclusions. Given the poor quality of evidence for estimating clinical effects, this could seriously undermine confidence in the findings of these evaluations and their ability to inform decisions concerning allocation of health care resources.

Poor-quality economic evaluation studies are not unique to Saudi Arabia. Previous studies have reported that developing countries\(^{23-27}\) lack sound economic evaluation data. Also, reviews of published economic evaluations from Europe and the US\(^{28-32}\) point to a number of shortcomings in the published literature. Formal and informal health economic guidelines have been issued in many countries to standardize and improve the quality of economic evaluation in health care.\(^{33}\)

Future recommendations

The findings of this review show that building an economic evaluation research capacity in Saudi Arabia is warranted. The author makes several recommendations. First, there is a need to establish a national agency or research institute to provide the infrastructure required to support and nurture health
Table 3 Quality of full economic evaluations (n = 10)

<table>
<thead>
<tr>
<th></th>
<th>Al-Tawfiq and Abed&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Sabry et al&lt;sup&gt;b&lt;/sup&gt;</th>
<th>Ali et al&lt;sup&gt;c&lt;/sup&gt;</th>
<th>Mammo et al&lt;sup&gt;d&lt;/sup&gt;</th>
<th>Abbas et al&lt;sup&gt;e&lt;/sup&gt;</th>
<th>Qari et al&lt;sup&gt;f&lt;/sup&gt;</th>
<th>Pejaver et al&lt;sup&gt;g&lt;/sup&gt;</th>
<th>Jawad et al&lt;sup&gt;h&lt;/sup&gt;</th>
<th>Al Umran and Yaseen&lt;sup&gt;i&lt;/sup&gt;</th>
<th>Kubeyinje&lt;sup&gt;j&lt;/sup&gt;</th>
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<td>Main outcomes presented with statistical measures of dispersion</td>
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<td>Yes</td>
<td>Yes</td>
<td>No</td>
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<td>Yes</td>
<td>No</td>
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<td>No</td>
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<td>No</td>
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</tbody>
</table>

Abbreviation: NC, not clear.
Table 4 Quality of partial economic evaluations (n = 5)

<table>
<thead>
<tr>
<th></th>
<th>Alsultan et al18</th>
<th>Alangari et al19</th>
<th>Jawadi and Abdul-Samad20</th>
<th>Almuneef et al21</th>
<th>Mitwali et al21</th>
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<tr>
<td>Perspective clearly stated</td>
<td>No</td>
<td>No</td>
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<td>No</td>
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<tr>
<td>Time horizon clearly stated</td>
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<td>Yes</td>
<td>NC</td>
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<td>Resources used reported in physical units</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td>Quantities of resources presented separately from prices</td>
<td>No</td>
<td>No</td>
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<td>No</td>
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<tr>
<td>Sensitivity analysis performed</td>
<td>No</td>
<td>No</td>
<td>No</td>
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</tbody>
</table>

Abbreviation: NC, not clear.

economic evaluation research. It could, for example, advise a process and criteria for priority setting of future economic evaluations in Saudi Arabia. It could also commission funds and facilitate procedures for synthesizing and disseminating the results of economic evaluation. This agency needs to build on the organizational and methodological experience of established health technology assessment agencies, such as the Australian Pharmaceutical Benefits Advisory Committee, the Canadian Agency for Drugs and Technologies in Health, and the National Institute for Health and Clinical Excellence in England and Wales. It would also be necessary to educate potential users about methods of economic evaluation, interpretation of economic evidence, and appraisal of cost-effectiveness claims. Efforts towards this end include expanding the availability of short-term and long-term courses on economic evaluation for health care professionals and policy-makers. Investment in teaching of economic evaluation in health care curricula is also required.

Limitations
This study may suffer from some limitations. It is possible that some published studies were inadvertently missed or omitted. The review only includes studies incorporated in the databases searched. This may mean that unpublished data, such as in government reports, pharmaceutical company reports, and academic theses, were not identified by the literature search. Furthermore, the inclusion of only published articles may have introduced publication bias, because studies with positive results are more likely to be published than studies with negative findings. In addition, the methods sections of many studies did not clearly describe what was done, making it difficult to categorize them, and other readers may categorize them differently.

Conclusion
This review indicates that there are major flaws in the design, analysis, and reporting of economic analyses performed in the Saudi health care setting. Such deficiencies mean that the findings of this evaluation may not be very useful in informing decisions on health care resource allocation. Thus, building research capacity in health economics is warranted in Saudi Arabia.

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References
26. Teerawattananon Y, Russell S, Mugford M. A systematic review of economic evaluation literature in Thailand are the data good enough to be used by policy-makers? Pharmacoeconomics. 2007;25:467–479.